6. Value And Returns

6.1 Time Preference for Money

> *"Time value of money" means the sum of money received in future is less valuable than the identical sum at present. The worth of rupee that is to be received after some time will be less than a rupee received today.*

The reason for time preference or time value of money is that we have the investment opportunities for funds which are received early. The funds so invested will earn a rate of return; this would not be possible if the funds are received in future time. Thus, time value for money is expressed in terms of a rate of return or more popularly as a discount rate.

For example, if you deposit Rs. 10000 in a bank as fixed deposit for one year and the rate of interest is 8% per annum, then you will receive Rs.10800 at the maturity after one year. Thus, a sum Rs.10000 worth more today than the same amount of sum after one year as during this time you can earn an interest of Rs.800 on the sum. The core principle of finance is that, sooner the money is received, more will be the worth of money.

The time value of money is also related to inflation and purchasing power of money. Due to inflation the purchasing power of money erodes. Thus, the purchasing power of a sum of money in future will be less than its purchasing power at present. For example, if petrol cost Rs.50 a litre than with Rs.150 you can purchase 3 litres of petrol. If the price of petrol increases to Rs.75 a litre than with the same amount of money you can purchase 2 litres of petrol. The purchasing power of Rs.150 decreases from 3 litres of petrol to 2 litres of petrol due to inflation.

Common terms used in ascertaining time value of money
PV = Present Value
FV = Future Value
r = Rate of Return
n = time period in years

Techniques to calculate time value of money

There are two methods used to find out the worth of money at different points of time. These are

- Compounding Technique
- Discounting Technique

Compounding Technique

This method is used to find the future value of present sum of money. Compounding helps to know the future value of cash flows at the end of a period at a definite rate of return. ***Thus, it converts the present value into future value.*** Interest is compounded when the amount earned on an initial principal amount becomes part of the principal at the end of every compounding period. Interest earned is added to initial amount to arrive at new principal for second compounding and so on. The formula used to calculate future value of a single cash flow is

$$\boxed{A_n = P(1+r)^n}$$

Where, A_n is the compounded amount or future value of Principal amount P

Suppose,

Principal amount P = Rs. 1000

Rate of Interest r = 5% per annum compounded annually

Number of years n = 3

Amount at end of

1^{st} year, $A_1 = 1000(1 + 0.05)^1$ = Rs 1050.00

2^{nd} year, $A_2 = 1050(1 + 0.05)^1$ = Rs 1102.50

3^{rd} year, $A_3 = 1102.50(1 + 0.05)^1$ = Rs 1157.625

or $A_3 = 1000(1 + 0.05)^3$ = Rs 1157.625

$$\boxed{\text{Future Value Interest Factor } FVIF_{r,n} = (1 + r)^n}$$

$$\boxed{\text{Future value can be calculated as } FV = P \times FVIF_{r,n}}$$

Semi-Annual Compounding

It means that there are two compounding periods within a year. Interest is paid after every six months at a rate of one-half of the annual rate of interest.

$$\boxed{FV = P(1+\frac{r}{2})^{nx2}}$$

where, FV = future value

Thus, rate of interest is halved, and n is multiplied by 2.

Quarterly Compounding

It means that there are four compounding periods of 3 months each in a year. Instead of paying full interest once a year, one-fourth of the interest is paid in four equal installments every quarter (4 quarters)

$$\boxed{FV = P\left(1+\frac{r}{4}\right)^{nx4}}$$

Monthly Compounding (12 months)

$$\boxed{FV = P\left(1+\frac{r}{12}\right)^{nx12}}$$

Compounding 'i' Times in a Year

(i periods in a year)

$$\boxed{FV = P\left(1+\frac{r}{i}\right)^{nxi}}$$

Remember: *The greater is the number of times compounding is done in a year, higher will be the future value or the yield or return.*

> ***'Rule of 72'***
> *This rule says that the number of years an amount will take to double itself can be approximately obtained by dividing 72 with the given fixed annual rate of interest. For example, at 6% annual rate of interest a sum will take 72/6 = 12 years to double itself.*

Discounting Technique

Discounting is an attempt to calculate the present value of a cash flow falling due on a future date. It is the reverse of compounding technique which tries to calculate the present value of future cash flows. ***It converts future value into present value.*** The formula is

$$\boxed{PV = A_n\left\{\frac{1}{(1+r)^n}\right\} = \frac{A_n}{(1+r)^n}}$$

or $PV = A_n \times PVIF_{r,n}$

Where $PVIF_{r,n} = \dfrac{1}{(1+r)^n}$

Where, A_n is the sum to be received in future after n years, r is the current rate of interest.

Table : Difference between Compounding and Discounting Techniques

Sr. No.	Compounding Technique	Discounting Technique
1	It is used to calculate future value of a present amount.	It is used to calculate present value of an amount to be received in future.
2	It means what amount will we get tomorrow if we invest a certain sum of money today.	It means what amount should we invest today to get a specific sum of money in future.
3	Future value factor table is used to calculate future value of a certain sum.	Present value factor table is used to calculate present value.
4	It uses compound interest rate.	It uses discount rates.

Present Value of Series of Cash Flows

In capital budgeting decisions, the present value of all the cash flows received by a firm every year can be determined as

$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + ... + \frac{C_n}{(1+r)^n}$$

or $$\boxed{PV = \sum_{i=1}^{n} \frac{C_i}{(1+r)^i}}$$

P = Total Present Value

C_1, C_2, C_3, ... C_n are cash flows in time period 1, 2, 3, ... n.

r = Rate of Interest

Present Value Interest Factor ($PVIF_{r,n}$) = $\frac{1}{(1+r)^n}$

$$PV = C_1(PVIF_1) + C_2(PVIF_2) + ... + C_n(PVIF_n)$$

$$\boxed{PV = \sum_{i=1}^{n} C_i(PVIF_i)}$$

Illustration : Mr. X wishes to determine the present value of future cash flows of next five years which are Rs. 1000, Rs. 2000, Rs. 3000, Rs.4000 and Rs. 5000 for every year, respectively. Assume that individual cash flows are discounted at 10% every year.

Year	Cash Flow	PVF	PV
1	Rs.1000	0.909	Rs.909.00
2	Rs.2000	0.826	Rs.1652.00
3	Rs.3000	0.751	Rs.2253.00
4	Rs.4000	0.683	Rs.2732.00
5	Rs.5000	0.621	Rs.3105.00
	Rs.15000		Rs.10651.00

Solution : The present value of Rs 15000 which a person can receive in different cash values in next five years is Rs 10651 discounted at rate of 10% for next 5 yr.

Present Value of Annuity

An annuity is a series of equal cash flows of an amount each year of a financial product. Bond, equity or any other investment that offers an investor a regular cash inflow each year can be valued in current period with the help of present value of annuity.

$$\boxed{PV = \sum_{i=1}^{n} C_i(PVIF_i) = C\sum_{i=1}^{n}(PVIF_i)}$$

where,C = Annual cash flow remains same = Annuity

$PVIF_i$ = Present value discounting factor for i^{th} year

Shortcut Method of Calculating PV of Annuity

Discounted at the rate of interest 'r' for 'n' years with annuity of value C.

$$\boxed{PV = \left\{\frac{(1+r)^n - 1}{(1+r)^n r}\right\} \times C}$$

Illustration : Mr. X wishes to find the present value of his annuity of Rs 1000 for a period of 5 yr. The rate of interest in current market is 10%.

Solution :

$$PV = \frac{(1+0.10)^5 - 1}{(1+1.0)^5 \times 0.10} = \frac{(1.10)^5 - 1}{(1.10)^5 \times 0.10} = 3.790$$

Thus, PV = C × PVF_i = 1000 × 3.790 = Rs 3790

Present Value of Infinite Life Annuity

- *An annuity that goes on for an infinitely long time period is termed as "perpetuity".*
- An annuity of value 'C' discounted at current rate 'r' has the present value

$$\boxed{\text{PV of Perpetuity} = \frac{C}{r}}$$

Future Value of Annuity

Bank, SIP, RDs offers recurring investment schemes. If an investor opts for such a scheme, he would be required to calculate what would be the value of his investment over a period. Shortcut method to calculate future value is

$$\boxed{FV = PV\left\{\frac{(1+r)^n - 1}{r}\right\}}$$

Illustration : Rs 1000 invested at the end of each year for next 5 years at the rate of 10%. What would be the amount of money an investor will receive after 5 years completion?

Solution :

$$FV = 1000\left\{\frac{(1+0.10)^5 - 1}{0.10}\right\} = 1000(6.105) = \text{Rs } 6105$$

Therefore, the investor would get Rs 6105 at the end of 5th year as future value of his annuity paid by him.

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